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HARMONIC: Bayesian model comparison for simulation-based inference

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Simulation-based inference techniques will play a key role in the analysis of upcoming astronomical surveys, providing a statistically rigorous method for Bayesian parameter estimation. However, these techniques do not provide a natural way to perform Bayesian model comparison, as they do not have access to the Bayesian model evidence.

In my talk I will present a novel method to estimate the Bayesian model evidence in a simulation-based inference scenario, which makes use of the learnt harmonic mean estimator. We recently implemented this method in a public software package, HARMONIC, which allows one to obtain estimates of the evidence from posterior distribution samples, irrespective of the method used to sample the posterior distribution. I will showcase the performance of HARMONIC in multiple simulation-based inference scenarios where the estimated evidence can be compared with exact analytical results, including an example of model selection in the analysis of gravitational waveforms.

The versatility of the model evidence estimation framework provided by HARMONIC, coupled with the robustness of simulation-based inference techniques, creates a new complete Bayesian pipeline for parameter estimation and model comparison from next-generation astronomical surveys.

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